

# Prevalence and Determinants of Readiness of Health Facilities for Quality Antenatal Care Services in Bangladesh

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## Research Article

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**Title**

Prevalence and determinants of readiness of health facilities for quality antenatal care services in Bangladesh

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1 **Abstract**

2 **Background**

3 The quality antenatal care (ANC) services can reduce the risk of the pregnancy complications, and  
4 hence reduce the maternal and child morbidity and mortality. To ensure the quality ANC services  
5 to the pregnant women, it is essential that healthcare providers should be fully prepared with six  
6 tracer indicators recommended by World Health Organization. In this study, the prevalence of  
7 readiness by selected covariates has been examined. Potential factors responsible for the readiness  
8 have also been identified.

9 **Methods**

10 Using data from nationally representative Bangladesh Health Facility Survey (BHFS), 2017, the  
11 readiness indices of health facilities providing ANC services have been measured based on the six  
12 tracer indicators of the service. The chi-square test has been applied to check the association of  
13 selected covariates with the readiness index, and to obtain the adjusted associations of covariates,  
14 we have carried out a multinomial logistic regression model.

15 **Results**

16 Only 4.26% of the facilities is found to provide quality ANC services to the pregnant women.  
17 Rural facilities have lower readiness to provide quality services compared to urban facilities [RRR:  
18 0.13, 95% CI: 0.06-0.31;  $p < 0.001$ ]. Community clinics and private hospitals are less likely to have  
19 medium or high readiness compared to public hospitals or clinics. The health facilities having  
20 specialist or MBBS doctors are more likely to be considered as ready for quality ANC services  
21 compared to others facilities. Regional difference exists in readiness for providing the service.

22 **Conclusion**

23 A huge gap has been found in the facilities of Bangladesh to provide quality ANC services. This is  
24 a high time to reduce this gap in achieving sustainable development goals related with maternity  
25 and neonatal mortality. The present study recommends that the government of Bangladesh should  
26 take necessary initiatives to fully prepare healthcare providers so that quality ANC services can  
27 be equally provided to each pregnant woman.

28 **Keywords:** Readiness, Antenatal Care, Health Facility, Multinomial Regression, Bangladesh

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## 41 **Background**

42 Antenatal care (ANC) is a widely accepted accessible and cost-efficient way to improve maternal  
43 and perinatal health outcomes [1]. ANC links women with health system and helps them to get  
44 proper information and advice regarding pregnancy complications, postnatal care including  
45 newborn care, promotion of early and exclusive breastfeeding, and planned birth spacing [2-4].  
46 Therefore, negative pregnancy outcomes can be impeded by identifying and treating maternal  
47 health complications during pregnancy through ANC [2] . Better quality antenatal care can promote  
48 a woman to choose skilled care for herself and her child at and after birth of the child [5-8].  
49 Furthermore, ANC could prevent maternal and neonatal deaths through prevention, treatment  
50 during pregnancy and also skilled care at and after childbirth [9]. Reducing maternal mortality  
51 ratio (MMR) as well as neonatal mortality rate (NMR) is considered as one of the global key  
52 priorities. In order to ensure this, the international community has adopted the third sustainable  
53 development goal (SDG 3) which aims to reduce MMR and NMR to 70 per 100000 live births and  
54 12 per 1000 live births, respectively by 2030 [10]. Despite some achievements, around 295000  
55 maternal deaths and 2.4 million neonatal deaths occur worldwide [10, 11]. Low resource countries  
56 account for majority of these deaths and most could be prevented if women had access to antenatal  
57 care [11-13]. As the reason for most maternal deaths is pregnancy or childbirth related  
58 complications, quality ANC could reduce such complications and hence results in lower maternal  
59 mortality [12]. Again, the risk of morbidity and mortality of their children can also be reduced by  
60 ensuring adequate maternity care during pregnancy [14].

61 Although four ANC visits during pregnancy are required to ensure the safety of mothers and  
62 their children, World Health Organization (WHO) recently revised ANC guidelines for most  
63 efficacious pregnancy outcomes [4, 15]. According to new guidelines, a minimum of eight ANC

64 visits in the absence of complications is recommended throughout pregnancy period, which will  
65 be challenging for developing countries to achieve this target due to many barriers [15]. Moreover,  
66 in order to meet this challenge, health facilities need to be well prepared with trained staffs,  
67 medicines, equipment, and infrastructure [8]. The availability and readiness to offer the services  
68 are important determinants of health care service utilization [8]. Increasing ANC utilization is  
69 essential to improve maternal and newborn health outcomes, but it fails to meet the targets of SDG  
70 3 if quality ANC offered by health facilities is poor [16, 17]. Availability of services is deemed  
71 as a primary requirement for high-quality care delivery: and investigating readiness of healthcare  
72 providers is critical for understanding quality of care [16]. Therefore, examining readiness to offer  
73 ANC is required to improve quality of ANC.

74         Although some progress has been made over the last two decades, Bangladesh is far away  
75 from achieving SDG 3 by 2030 [18]. The Health, Population and Nutrition Sector Development  
76 Program (HPNSDP) has set a target that 50 percent of pregnant women should complete at least  
77 four ANC visits by 2022 in Bangladesh [2]. The Bangladesh Demographic and Health Survey  
78 (BDHS), 2017 showed that 82 percent of women received ANC from a skilled provider, while  
79 only 47 percent had completed four or more ANC visits during the last pregnancy [18]. Lack of  
80 access to health facilities and skilled health providers are responsible to refrain women from  
81 receiving four or more ANC visits during pregnancy in Bangladesh [9]. Previous studies showed  
82 that women receiving ANC late in the pregnancy reported poor experiences because of inadequate  
83 time for counselling and mistreatment from providers [19, 20]. Furthermore, maternal as well as  
84 neonatal mortality and morbidity can be reduced by assuring quality antenatal care services  
85 through high readiness of health care facilities [19, 21].

86 To provide information on health system functioning and readiness of health care facility  
87 services, Service Provision Assessment (SPA) or Health Facility Survey (HFS) has been conducted  
88 in developing countries. A number of HFSs has also been conducted in Bangladesh to assess  
89 availability and readiness of several facility-based health care services such as child health,  
90 antenatal care and newborn care, family planning (FP) as well as services for selected non-  
91 communicable diseases (diabetes, cardiovascular diseases) and tuberculosis. The Bangladesh HFS  
92 (BHFS), 2017 reported that almost all (99%) health facilities offer antenatal care services in  
93 Bangladesh, whereas only 4% are ready to provide quality ANC services according to World  
94 Health Organization (WHO) criteria [2]. To confirm better quality antenatal care services at health  
95 facilities, the huge difference between the availability and the readiness of these services needs to  
96 be reduced.

97 Although several studies have been conducted in Bangladesh to explore readiness of  
98 healthcare facilities to provide general health services [22], non-communicable diseases [23-27],  
99 child curative care [28] and child immunization services [29], readiness to provide quality ANC is  
100 still unexplored. So, this study has made first attempt to investigate on readiness of antenatal care  
101 services in Bangladesh. The purpose of the study is to find out the prevalence and influential  
102 factors of readiness for providing quality ANC services in Bangladesh. For this purpose, BHFS,  
103 2017 data has been utilized.

## 104 **Methods**

### 105 *Data*

106 This study utilized data derived from nationally representative Bangladesh Health Facility Survey  
107 (BHFS), 2017. The BHFS, 2017 was based on service provision assessment (SPA) and conducted

108 in Bangladesh under the authority of National Institute of Population Research and Training  
109 (NIPORT) of Ministry of Health and Family Welfare (MOHFW) with financial assistance of  
110 Government of Bangladesh and U.S. Agency for International Development (USAID). The sample  
111 of 2017 BHFS was a stratified random sample of 1600 health facilities selected from all registered  
112 health facilities across all eight administrative divisions in Bangladesh. Finally, interviewers  
113 successfully collected information from 1524 health facilities.

114 In this study, in order to assess the readiness of antenatal care services, the facilities which offer  
115 antenatal care services were selected. Among the interviewed facilities, 1505 facilities were  
116 reported available to provide ANC services and those facilities were taken in this study. Again,  
117 data have been weighted i.e., complex survey design has been used in the study in order to avoid  
118 overestimation or underestimation problem.

### 119 *Outcome Variable*

120 We used service availability and readiness assessment (SARA) reference manual of WHO to  
121 identify the items or tracer indicators that a facility needs to offer quality ANC services [30]. To  
122 define the readiness of facilities providing antenatal care, less restrictive as well as Bangladesh  
123 context-oriented version of ANC service readiness measure has been applied in this study [2]. To  
124 serve this purpose, six tracer indicators under five domains given in Table 1 have been used.

125

126 **(The Table 1 here)**

127

128 In the study, outcome variable was readiness of health facilities to offer antenatal care services.

129 The readiness index was created by WHO approach, where equal weights were given to each

130 domain of indicators/ items and also to each item at each weighted domain for providing antenatal  
 131 care services. The above six items are considered for each facility and summed up to generate  
 132 weighted mean readiness score [8, 28, 30, 31]. Finally, mean score was multiplied by 100 to obtain  
 133 the results of readiness score in percentage. Mathematically, the readiness score for the  $i^{th}$  facility  
 134 can be expressed as follows [28]

$$135 \quad Y_i = \left( \frac{1}{m} \sum_{j=1}^m \frac{1}{p_j} \sum_{k=1}^{p_j} z_{ijk} \right) \times 100 ; i = 1, 2, \dots, n; j = 1, 2, \dots, m; k = 1, 2, \dots, p_j,$$

136 where  $Y_i$  is the score of  $i^{th}$  case (facility),  $m$  is the number of domains,  $p_j$  is the number of  
 137 indicators/items in  $j^{th}$  domain,  $z_{ijk}$  is the value of  $k^{th}$  indicator in  $j^{th}$  domain for  $i^{th}$  case (facility),  
 138 and  $n$  is the total number of facilities. This readiness index was a continuous variable giving value  
 139 between 0 and 100. The higher value of readiness score indicates higher ANC service readiness of  
 140 the health facilities whereas lower value implies lower readiness.

141 Based on the readiness scores, the health facilities were divided into three categories in this  
 142 study. The facilities with readiness score 75 or below are considered as having low readiness;  
 143 facilities with 75 to 99 score considered as having moderate readiness; and facilities with 100 score  
 144 considered to be highly ready (complete readiness) to offer antenatal care services. Thus, the  
 145 readiness score was categorized as low, medium and high readiness in this study.

### 146 *Covariates*

147 In the study, based on the previous studies on readiness of health facilities, the six covariates were  
 148 selected to explore how these are associated with the readiness of facilities to provide antenatal  
 149 care services [23, 28, 32, 33]. The covariates are: location of facility (Urban and Rural), type of  
 150 facility (Public hospitals or clinics, Community Clinics, Non-Governmental Organization (NGO))

151 hospital or clinics and Private hospitals), health provider status (Assigned and Not assigned),  
152 qualification of health provider (Specialist or MBBS Doctors and Others), basic amenities in  
153 facility (Inadequate, Moderate and Adequate amenities) and division (Barisal, Chattogram, Dhaka,  
154 Khulna, Mymensingh, Rajshahi, Rangpur and Sylhet). The providers who are posted in a facility  
155 are defined as the assigned provider, and who are hired or seconded/deputed in the facility are  
156 defined as not assigned provider in the study. The variable “basic amenities” was created from  
157 observed information on nine amenities which are 1. national electricity grid availability, 2. regular  
158 electricity, 3. improved water source, 4. visual and auditory privacy, 5. client latrine, 6.  
159 communication equipment, 7. computer with internet 8. emergency transport, and 9. separate  
160 latrine or toilet for female clients. Based on the availability of the amenities, each of these  
161 amenities was created as indicator variables (Yes/No). In this study, the principal component (PC)  
162 analysis technique has been used to obtain a score index of basic amenities from nine indicator  
163 variables for reducing dimensionality. Higher score of a facility as compared with any other  
164 facilities indicates that the facility has more amenities than other facilities. The score index is  
165 continuous variable and also named as basic amenities in facility in this study. The distribution of  
166 scores was divided into three equal segments based on quantiles for study purpose. The lower part,  
167 middle part and upper part of score index were named as inadequate, moderate and adequate  
168 amenities, respectively.

### 169 **Statistical analysis**

170 To obtain the descriptive statistics for the selected variables, percentage frequency was computed.  
171 To check associations between several covariates and readiness of antenatal care services, the chi-  
172 square test was used in the study. Since readiness of antenatal care service is a polytomous outcome  
173 variable, multinomial logistic regression model was used to determine adjusted associations of

174 covariates with readiness of facilities [34]. STATA 14 package has been used in the study for  
175 analyzing the data.

## 176 **Results**

177 Results obtained from univariate and bivariate analyses have been reported in Table 2. Table 3  
178 represents the results of regression model.

### 179 **Univariate Results**

180 Table 2 reveals among 1505 health facilities offering ANC, only 4% are completely ready to  
181 provide ANC services in Bangladesh, while about 73% facilities have lower readiness. More than  
182 half of health facilities giving ANC (55%) have at least one staff who have in-service training for  
183 ANC, while fewer than half of health facilities (46%) follow ANC guidelines. Majority of health  
184 facilities have reported the availability of blood pressure apparatus and necessary medicines (iron  
185 and/or folic acid tablets), whereas only fewer (14%) have confirmed the availability of functioning  
186 equipment and reagents required for diagnostic test (hemoglobin and urine protein test) at the  
187 facility. Most of facilities offering antenatal care services are from rural areas (about 93%).  
188 Among the facilities, approximately 67% of interviewed facilities are community clinics, whereas  
189 only 3% and 4 % are private hospitals and NGO hospital or clinics, respectively. More than nine  
190 in ten of health facilities (98%) have assigned health providers. Again, only 8% of facilities  
191 offering antenatal care services have health professionals who are specialists or MBBS doctors.  
192 The distribution of facilities having inadequate, moderate and adequate basic amenities are almost  
193 similar. Approximately 20% and 19% of facilities offering antenatal care services situated in  
194 Dhaka and Chattogram respectively, as compared with only 6% and 7% of those were from Sylhet  
195 and Barisal respectively.

## 196 **Bivariate Results**

### 197 *Overall Readiness*

198 From Table 2, it is observed that all the selected covariates except health provider status have  
199 significant associations with readiness of facilities to offer antenatal care services. About 23% of  
200 urban facilities are completely ready to provide antenatal care services, as compared with 3% of  
201 rural facilities. Again, approximately 45% and 31% of facilities located in urban areas have low  
202 and medium readiness of antenatal care services, respectively, whereas 75% and 23% of rural  
203 facilities are observed to have low and moderate readiness respectively. Among public hospitals  
204 or clinics, about 9% facilities have full readiness, while about 64% facilities have poor readiness  
205 to provide such services. Approximately eight in ten of the community clinics have lower  
206 readiness, whereas only 1% of community clinics are completely ready to ensure antenatal care  
207 services to their clients. More than half of NGO hospitals or clinics (56%) are moderately ready to  
208 give the services, whereas fewer the one-fourth of those facilities have complete (23%) and lower  
209 (22%) readiness, respectively. Again, most of private hospitals (84%) have low readiness as  
210 compared with 14% and 2% of private hospitals with moderate and full readiness of providing the  
211 services, respectively. About 2% of facilities not having assigned health providers have complete  
212 readiness, whereas 4% of those having assigned health providers are fully ready to give the services  
213 on antenatal care. Table 2 demonstrates that facilities who have specialist or MBBS doctors as  
214 health providers (17%) are more likely to ensure highly ready service for antenatal care than those  
215 who have other health professionals (3%). As basic amenities index increases, the low readiness  
216 of antenatal care facility services also decreases from 82% of facilities with inadequate amenities  
217 to 66% of those with adequate amenities. By division, the percentage of facilities with high  
218 readiness to offer antenatal care varies from a low of 2% in Rangpur to a high of 7% in Sylhet.

219 **Domains (Tracer indicators) of Readiness**

220 Readiness to provide quality ANC services is measured based on five domains recommended by  
221 WHO, which are: trained staff for ANC at any time, guidelines on ANC, equipment (blood  
222 pressure apparatus), diagnostic capacity (hemoglobin and urine protein test) and medicines (iron  
223 and/or folic acid tablets). Table 2 shows that among five domains, availability of medicines (iron  
224 and/or folic acid tablets) to offer better ANC is highest (93%), whereas only 14% of health  
225 facilities have reported necessary functioning equipment and reagents for diagnostic test  
226 (hemoglobin and urine protein test) available at the facility.

227 **(The Table 2 here)**

228

229 ***Trained Staff for ANC at any time***

230 Approximately 55% of health facilities offering ANC services have at least one staff who have in-  
231 service training on ANC. All covariates except type of facility and division exhibit no significant  
232 association with training on ANC for at least one staff member of the facility. Among four types  
233 of facilities, NGO hospitals or clinics are most likely to have at least one staff who received training  
234 for ANC (64%), whereas private hospitals are least likely to have trained staff for ANC (26%).  
235 Health facilities located in Rangpur are least likely to have trained staff for ANC compared to  
236 those located in other divisions.

237 ***Guidelines on ANC***

238 About 46% of health facilities providing ANC have reported ANC guidelines available at the  
239 facility on the day of interview of the survey. Among all selected covariates, only type of facility

240 and division have significant association with availability of ANC guidelines. Only 7% of private  
241 hospitals follow ANC guidelines, while about three-fourth of NGO hospitals or clinics (75%) have  
242 reported to have ANC guidelines available. Approximately three in ten of facilities in Sylhet have  
243 ANC guidelines, whereas two-third of facilities located in Khulna follows ANC guidelines.

#### 244 ***Equipment (blood pressure apparatus)***

245 More than eight in ten of facilities offering ANC have confirmed the availability of functioning  
246 digital blood pressure machine or functioning manual sphygmomanometer with stethoscope at the  
247 facility. All the covariates except health provider status are significantly associated with the  
248 availability of blood pressure apparatus. About 97% of urban facilities have functioning blood  
249 pressure apparatus as compared with 86% of rural health facilities. Community clinics are least  
250 likely (83%) to avail functioning blood pressure apparatus compared to other facility types. More  
251 than nine in ten of facilities who have specialist or MBBS doctors as health providers have reported  
252 blood pressure apparatus available for antenatal care as compared with 85% of facilities who have  
253 other health professionals. With increasing basic amenities, the availability of blood pressure  
254 apparatus increases from 79% of facilities with inadequate amenities to 92% of those with  
255 adequate amenities. Health facilities of Barisal are least likely (80%) to have functioning blood  
256 pressure machine than those of other divisions.

#### 257 ***Diagnostic capacity (hemoglobin test and urine protein test)***

258 Only 14% of health facilities giving ANC services have reported functioning equipment and  
259 reagents needed to conduct diagnostic tests for ANC (hemoglobin test and urine protein test)  
260 available at the facility. All covariates but health provider status have significant association with  
261 the capacity to run tests for hemoglobin and urine protein. Only 9% of rural facilities have

262 available equipment and reagents for hemoglobin and urine protein tests as compared with around  
263 three-fourth of urban facilities. About 6% of Community clinics and 17% of public hospitals or  
264 clinics have the capacity for hemoglobin and urine protein tests, whereas more than 70% of NGO  
265 hospitals/clinics as well as private hospitals are capable to conduct these tests. Facilities with  
266 specialist or MBBS doctors (67%) are almost 7.5 times as likely as those with other health  
267 providers (9%) to conduct these tests. Again, facilities with adequate basic amenities are three  
268 times as likely as those with inadequate amenities to perform these tests. Facilities of Rangpur are  
269 least likely (5%) to conduct hemoglobin and urine protein tests compared to those of other  
270 divisions.

#### 271 *Medicines (iron and/or folic acid tablets)*

272 Majority of health facilities that offer ANC have essential medicines (iron and/or folic acid tablets)  
273 for ANC. Each selected covariate has been observed to have significant association with  
274 availability of these medicines needed for ANC. About 88% of urban facilities have iron  
275 supplements and/or folic acid tablet as compared with 93% of rural facilities. Private hospitals are  
276 least likely (78%) to have these essential medicines than other facility types. About 80% of  
277 facilities not having assigned health providers have these two medicines, whereas 93% of those  
278 having assigned health providers reported to have these medicines available at the facility.  
279 Approximately nine in ten of facilities with specialist or MBBS doctors have these medicines,  
280 while 93% of facilities who have other health professionals have confirmed these medicines  
281 available for antenatal care. The availability of iron and/or folic acid tablets increases as basic  
282 amenities index increases. Facilities of Chattogram (83%) and Sylhet (85%) are less likely to have  
283 these medicines available than facilities of other divisions.

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## 286 **Multinomial logistic results**

287 The covariates found to be significantly associated with readiness on antenatal care services in  
288 bivariate analysis are selected for multivariate analysis. In this study, multinomial logistic  
289 regression analysis has been performed considering low readiness as baseline outcome category  
290 for the comparison with medium readiness and high readiness. Table 3 shows the coefficients,  
291 relative risk ratios (RRR) with 95% confidence intervals, p-values obtained from analysis.

### 292 *Medium versus low readiness*

293 Table 3 reveals that the urban and rural facilities have the equal risk for being moderately ready  
294 relative to lower ready to provide the ANC services [RRR 1.05; 95% CI: 0.56-1.99; p-value 0.880].  
295 The relative risk of NGO hospitals or clinics are 4.68 times compared to public hospitals or clinics  
296 to provide average quality of antenatal care services [RRR 4.68; 95% CI: 2.54-8.62; p<0.001]. By  
297 contrast, community clinics and private hospitals have 31% [RRR 0.69; 95% CI: 0.47-0.99, p-  
298 value 0.048] and 88% [RRR 0.12; 95% CI: 0.05-0.27; p<0.001] lower probability to be medium  
299 ready to offer ANC compared to public hospitals or clinics, respectively. The relative risk of being  
300 average ready relative to lower ready for ANC service would be expected to increase by a factor  
301 of 4.06 among the facilities with qualified physician i.e., specialist or MBBS doctors as health  
302 providers than those with other health providers [RRR 4.02; 95% CI: 2.24-7.21, p<0.001]. Again,  
303 the expected risks of having average readiness are increased by 2.54 [RRR 2.54; 95% CI: 1.52-  
304 4.26, p<0.001] and 1.70 [RRR 1.01; 95% CI: 1.01-2.88, p-value 0.047] for those facilities which  
305 have moderate and adequate basic amenities, respectively compared to the facilities with  
306 inadequate basic amenities. Facilities of Chattogram, Khulna and Mymensingh are significantly

307 associated with the increased probability of providing medium quality of ANC services compared  
308 to facilities located in Dhaka. Location of facility has no significant effect on medium readiness  
309 vs. low readiness to deliver ANC services.

### 310 *Complete versus low readiness*

311 Table 3 also demonstrates the results of the comparison between high and low readiness for  
312 delivering antenatal care services. The fact that a facility is located in rural area reduces the risk of  
313 being complete readiness relative to low readiness to provide the services by a factor of 0.13  
314 compared to an urban facility [RRR 0.13; 95% CI: 0.06-0.31,  $p < 0.001$ ]. Community clinics and  
315 private hospitals also decrease the probabilities for getting the quality ANC services by the factor  
316 of 0.15 and 0.02, respectively compared to public hospital or clinics. On the other hand, the relative  
317 risk of NGO hospitals or clinics are 2.63 times compared to public hospitals or clinics to provide  
318 full quality of antenatal care services [RRR 2.63; 95% CI: 1.27-5.46;  $p$ -value 0.010]. The chance  
319 of giving quality ANC services increases by a factor of 2.22 when a facility has MBBS doctor or  
320 specialist health provider [RRR 2.22; 95% CI: 0.97-5.08,  $p$ -value 0.058] and it is noted that the  
321 evidence is justified at 10% level of significance. Compared to the facilities having inadequate  
322 basic amenities, the expected risk of giving quality ANC services are found to be equal among the  
323 facilities having average or adequate basic amenities. Facilities of all divisions except Rangpur are  
324 significantly associated with increased chance of getting higher readiness to offer ANC services  
325 compared to facilities of Dhaka.

### 326 **Discussion**

327 The aim of the present study is to evaluate the readiness of health facilities to provide proper  
328 antenatal care (ANC) services among pregnant women and also to determine its associated factors

329 using data from the National Survey of Bangladesh. To our knowledge, this is the first study to  
330 assess the readiness for offering ANC services in Bangladesh following WHO recommendation  
331 regarding service readiness indicators using a nationally representative health facility survey,  
332 where the health facilities were considered as sampling units. However, the survey found a huge  
333 quality gap for providing ANC services. Most facilities (72.11%) are poorly prepared, i.e., the  
334 indicators for ANC services are not adequately available to provide ANC services, where only  
335 4.26% are fully prepared to provide. Again, compared with other indicators of ANC, diagnostic  
336 capacity (hemoglobin and urine tests) was not found in most facilities (13.66%), although  
337 diagnosis is required at this stage of pregnancy for better health of women as well as their preterm  
338 infants. The lack of WHO-recommended indicators for ANC in any facility may refrain women  
339 from visiting four or more ANCs as the previous studies have shown that optimal ANC coverage  
340 often depends on the availability, cost-effectiveness, and quality of ANC services [35-38]. It is  
341 noted that only 47% of women received healthcare four or more times from providers during their  
342 pregnancy in Bangladesh [18]. Nevertheless, the equipment (blood pressure apparatus) and drugs  
343 (iron or folic acid tablets) for ANC are now in a better position in terms of availability in  
344 Bangladesh than other proposed requirements. Findings related to the readiness of health facilities  
345 for quality ANC services are consistent with the studies in Nepal and Ethiopia that the health  
346 facilities did not meet the requirements set by WHO guidelines [8, 17]. Again, another study  
347 conducted in India also measured the low quality of ANC services, although the study defined the  
348 quality of ANC services based on clinical quality, interpersonal quality of care and utilization of  
349 ANC measures [39]. A study on quality ANC readiness in sub-Saharan Africa found out the  
350 readiness in specific tracer indicators of ANC services, where most of the countries selected in the  
351 study had better readiness than Bangladesh in availability of trained staff, ANC guidelines and

352 Iron supplementation [16]. In addition, compared to previous survey of 2014 BHFS, the present  
353 study did not find any considerable change in preparedness of the health facilities to provide ANC  
354 services [40].

355 **(Table 3 is here)**

356 This study also found some potential factors responsible for lower readiness of health facilities to  
357 offer ANC services. In the study, the outcome variable “readiness index” have three categories,  
358 and lower readiness was considered as the reference (or base) category for both medium and high  
359 readiness to run the multinomial logistic regression model. The urban and rural location of the  
360 facilities do not have significant difference in medium readiness but exist difference in high  
361 readiness, and rural facilities are less likely to be ready fully for providing ANC services compared  
362 to urban facilities. Several studies found the similar findings, where the studies explored the  
363 general services readiness, and explained the reasons behind the finding that ineffective coverage  
364 of health facilities in rural facilities and tertiary or highest-level care in urban facilities [22, 41-  
365 44]. Usually, the qualified health professionals are available to provide maternal health services in  
366 most urban facilities compared to rural facilities [18, 45], and according to their advice to their  
367 patients regarding the hemoglobin test, urine test, blood pressure apparatus and taking of iron or  
368 folic acids tablets, the authorities of urban facilities try to provide these necessary ANC services  
369 in the facilities. Again, the discrimination between urban and rural facilities was also observed in  
370 bivariate analysis for the above services (Table 2). There may have another reason behind this  
371 difference that comparatively the urban people are educated and more concerned about their  
372 health, and naturally, they will try to get the quality services from the health facilities which  
373 indirectly may influence the managing authorities in urban facilities to provide quality ANC  
374 services. Again, The finding of medium readiness versus low readiness was consistent with a

375 recent study in Ethiopia [8], where the study did not find any significant difference by location of  
376 facilities in providing ANC services. The reverse situation was observed in Burkina Faso, Ghana  
377 and Tanzania that the rural health facilities had a satisfactory level of quality ANC service [46].

378 The facility types significantly influence the preparedness of the facilities for providing ANC  
379 service, and the readiness is better in NGO hospitals or clinics but it is not good in private hospitals  
380 or community clinics compared to public hospitals or clinics. Similar studies were found in  
381 Ethiopia, Vietnam, and India, where the studies revealed that public health facilities were better in  
382 readiness than the private facilities to provide ANC service [8, 47, 48]. The finding was also  
383 consistent with a study of 46 low and middle-income countries, and the study revealed that public  
384 facilities are the primary source of getting ANC services in a country [8, 49]. This might be  
385 happened due to the reason that the government health monitoring team may routinely monitor the  
386 public health facilities for ensuring quality health services, and the Directorate General of Health  
387 Services (DGHS) has already taken the initiative of measuring performance, ranking, and  
388 rewarding the different tiers of health facilities in 2014 for improvement of health services in the  
389 public health sector. Again, the opposite scenario of providing the services was observed in NGO  
390 facilities. NGO hospitals or clinics in local areas are mainly functioned to help the poor local  
391 people and run by financial assistance from the Government of Bangladesh and foreign donors.  
392 Many NGOs have succeeded in providing child and maternal health services to their clients. In  
393 addition, USAID and other international organizations provide grants and funds to NGOs to  
394 provide quality health services, and also the organizations monitor the NGO facilities to strictly  
395 follow the guidelines [22, 50].

396 The preparation of health facilities for the delivery of quality ANC services also depends on the  
397 qualifications of the health provider. The facilities having qualified physicians, such as specialists

398 or MBBS doctors, are more likely to be considered as ready to provide ANC services than other  
399 facilities. Recently, the WHO has recommended eight or more health check-ups on women during  
400 pregnancy by qualified health professionals in healthcare to reduce pregnancy-related  
401 complications that result in death in the mother or their newborn [15]. Thus, the qualifications of  
402 a health provider play an important role in providing quality healthcare in any facility. Eligible  
403 physicians are always up to date on any guidelines related to health issues and they may be able to  
404 persuade managing authorities of the facilities to strictly follow WHO guidelines regarding the  
405 availability of ANC service indicators.

406 The basic amenities of health facilities significantly associated with medium readiness but it did  
407 not affect the high readiness to provide ANC services. Investigations prove that it is not always  
408 true that well-equipped healthcare provides quality ANC services, as there is no difference among  
409 inadequate, moderate and adequately equipped facilities in quality services. For example, private  
410 hospitals are generally equipped with more basic amenities than public hospitals [2, 22], but our  
411 research has shown that private hospitals are less prepared to provide quality ANC services. But  
412 this study suggests that health facilities should have adequate basic facilities in addition to  
413 maintaining the quality of service.

414 A significant association among division and readiness index was observed in the study, where the  
415 health facilities from Chattogram, Khulna and Mymensingh regions were more likely to have  
416 average or complete readiness to provide the ANC service compared to Dhaka region, but the  
417 facilities from Rangpur and Dhaka regions were equally likely to have medium or complete  
418 readiness for providing the service. Again, the facilities from Barisal, Rajshahi and Rangpur  
419 regions had the higher risk of being completely ready, but these facilities had no enough evidence  
420 to exist the difference related to medium readiness with the facilities in Dhaka region. This can

421 happen due to regional variation in providing health services or access to better health facilities  
422 [28]. Similar results were also found in several studies for quality ANC services [8, 49].

### 423 **Limitations**

424 This study focused only on the preparedness of health facilities to provide ANC services for  
425 intervention, but didn't provide a guarantee for ensuring quality ANC services. Because, to ensure  
426 quality services, we also need to include the followings: health provider knowledge, provider  
427 effort, motivation, supervision or increased workloads [16, 51] which are not available in the SPA  
428 survey. Another limitation is the arbitrary use of cut-off points (below 75%, 75-99%, and 100%)  
429 to define the categories of outcome variable "readiness index" that may incorrectly classify the  
430 readiness for ANC service delivery. Again, the causal relationship of the factors with readiness of  
431 health facilities cannot be examined cause, as the BHFS or SPA data was in a cross-sectional setup.  
432 Moreover, the lack of previous studies related to the readiness of health facilities for the provision  
433 of ANC services using SPA or HFS data has made it difficult to compare the results of the current  
434 study with those of other studies.

### 435 **Conclusion**

436 The quality of ANC services is extremely poor in Bangladesh. So, in order to provide quality ANC  
437 services, it is necessary to accelerate the availability of several ANC service indicators. Reducing  
438 the gap in quality ANC services can be a positive aspect in reaching SDGs related to maternity  
439 and neonatal mortality [9, 17, 52, 53]. Again, to ensure the readiness among the facilities for  
440 improving quality, routine and robust monitoring in health facilities are required [17, 54]. The  
441 Ministry of Health and Family Welfare (MOHFW) is in charge of providing primary healthcare in  
442 rural areas through various channels. Among the channels, the community clinics and subdistrict

443 health complexes play a major role to provide quality healthcare services in rural areas. Therefore,  
444 the MOHFW should take the responsibility for ensuring quality ANC services in rural areas by  
445 improving and monitoring the community clinics and subdistrict health complexes. This study  
446 recommends that the government of Bangladesh should take the initiative of engaging qualified  
447 health professionals and arranging routine monitoring in rural health facilities for getting quality  
448 health services. In addition, the DGHS should offer incentives to private health facilities to follow  
449 the provision and integration of ANC services.

#### 450 **Abbreviations**

451 ANC: Antenatal Care; WHO: World Health Organization; HFS: Health Facility Survey; BHFS:  
452 Bangladesh Health Facility Survey; MMR: Maternal Mortality Ratio; NMR: Neonatal Mortality  
453 Rate; SDG: Sustainable Development Goal; HPNSDP: Health, Population and Nutrition Sector  
454 Development Program; BDHS: Bangladesh Demographic and Health Survey; SPA: Service  
455 Provision Assessment; FP: Family Planning; NIPORT: National Institute of Population Research  
456 and Training; MOHFW: Ministry of Health and Family Welfare; USAID: United States Agency  
457 for International Development; SARA: Service Availability and Readiness Assessment; NGO:  
458 Non-Governmental Organization; MBBS: Bachelor of Medicine, Bachelor of Surgery; PC:  
459 Principal Component; RRR: Relative Risk Ratio; CI: Confidence Interval; DGHS: Directorate  
460 General of Health Services.

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467 **Availability of data and materials**

468 This study entails a secondary analysis of data from 2017 BHFS. The original survey dataset was  
469 available online at <https://dhsprogram.com/data> and the data set was freely downloadable after  
470 completing a registration at the website of DHS program.

471 **Authors' contributions**

472 KKS and SN conceptualized and initiated the research question. FTZ and SN carried out the  
473 literature review. KKS and SN conducted the statistical analysis. All authors contributed equally  
474 in drafting the manuscript. WB supervised the entire study, reviewed the manuscript and  
475 incorporated changes as applicable. FTZ and WB finalized latest version. All authors read and  
476 approved the final manuscript.

477 **Ethics approval and consent to participate**

478 The survey used a freely available secondary survey data set (BHFS, 2017) which is available  
479 online (<https://dhsprogram.com/data>). The survey was approved by the Ethics Committee of ICF  
480 Macro in Calverton, USA, and by the National Institute of Population Research and Training  
481 (NIPORT) in Bangladesh, and the authority taken a permission from the participants i.e., facility  
482 in charge to participate in the survey (2017), and all participants signed in a consent form. Thus,  
483 ethical approval and consent to participate were automatically deemed unnecessary for the current  
484 study.

485 **Consent for publication**

486 Not applicable

487 **Competing interests**

488 The authors declare that they have no competing interests.

489

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